

Date: Wed, 27 Dec 95 13:41:57 EST
From: Alex McKenzie <mckenzie@BBN.COM>
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Subject: Thoughts about Internet Protocol Development

Katie,

This is typed with 1 finger so it might be cryptic. Talking by phone would still be good

* By October 1972 there were 3 important packet network activities around the world:

- ARPANET
- Cyclades/Cigale
- NPL network

You already know about ARPANET. The stuff at NPL grew out of Donald Davies work and was being carried on by a group which included Derek Barber, Roger Scantlebury, Keith(?) Bartlett, and Peter(?) Wilkinson. Cyclades was a network developed by the Institute of Research for Informatics and Automation (IRIA) near Paris. The director of Cyclades was Louis Pouzin and some of the people working for him were Hubert Zimmermann, Michel Elie, Gerard LeLann, and Jean-Louis Grange.

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* When INWG was organized at the 1972 ICCO in Washington, CERF, Kahn, Barber, and Pouzin were all present. At that time Pouzin was a member of IFIP TC 6 (International Federation for Information Processing, Technical Committee 6). TC 6 was responsible for Data Communications. Pouzin accepted the task of getting INWG "accredited" as a subcommittee of IFIP TC 6 so as to gain some international stature. This made it impolitic for Pouzin to be the INWG chair. Barber had responsibility for EIN and was dealing with a lot of intra-European politics which made it seem inappropriate for him to be chair. These factors had as much to do with Vint's selection as INWG chair as anything else.

* Cigale was the packet switching subnet of Cyclades (Cyclades was a name that included all the hosts and protocols). Cigale was built according to the principle that the packet switches should do almost nothing except forward packets which passed a checksum test. Unlike the IMPs there was no reassembly, no reordering, no duplicate detection, etc. In their minimalist functioning the Cigale nodes were very close to the switches envisioned by Baran. Pouzin's thinking about why the Cigale switches should not try to do much work to insure reliability is summed up on page 6 of INWG Note #50 (which he presented in Brighton):

"But no physical system is perfect. Even though the communications component would correct errors, there would still be unrecoverable or undetected ones. Consequently the user protocol must be designed to make up for rare yet undesirable communications error, lest being occasionally fooled."

"It may cost the same at user level to detect and correct rare or not quite rare failures. Therefore why put additional mechanisms at communications level?"

"Behind all this rationale there is a subjective premise: 'I trust my part, not yours'."

* Another packet networking project which was started in about 1971 was the "European Informatics Network, also known as COST-11. (COST was the acronym for something like "Committee On Science and Technology"

of the Common Market, and EIN was the 11th project they funded.) EIN was envisioned as a European "backbone" which would connect the NPL network, Cyclades, and some other European research center (I remember one of them was a Technical University in Zurich, and another was the Milan Polytechnic.) Derek Barber was the first director of EIN (he presented a paper about it at the 1972 ICCG in Washington), and he and Pouzin were concerned about how the NPL network and Cyclades would interact with EIN, and with each other via EIN. Therefore they themselves, and their workers Scantlebury, Zimmermann, and Elie, were all very concerned with Internet connection. Pouzin especially argued that it would be easiest to interconnect minimalist networks (like Cigale) into a "Catenet". In an EIN workshop at the end of April he stated: "Another consequence is that several networks of that type can be put together and make up a single network, This is the recursive structure property applied outwards. Indeed, every network can be modeled as a node, hence several networks are a network." [see page 21, para 3, of INWG #49]

- * Pouzin had been involved in multi-processor studies before he was involved in networking. His mental model of networking was that a network represented a geographically-distributed, heterogeneous, multiprocessor. Therefore Pouzin and his team at IRIA approached the design of network interconnection from a multiprocessor perspective. They looked at ways to structure the protocol so as to reduce "multiprocessor overhead". One evidence of this is that all the French protocol proposals dealt in fixed-length fragments (for processing ease) while the Cerf/Kahn proposal dealt in fragmentation between any 2 octets (for maximum flexibility).
- * Pouzin lived in an environment where the communications were provided by a ponderous government bureaucracy - the French PTT. There is little to be surprised at in Pouzin's concept that "components are to be legitimately mutually suspicious." [page 6, item 'g', INWG #50] Cerf and Kahn came from an environment where the communications providers were somewhat more responsive, but they chose the same approach because they did not like to see the network be so complex and sensitive to change that their networking ideas could be held hostage by an unsympathetic packet switch supplier. Bob remembered his fights with Crowther about IMP software design. Vint remembered how hard it sometimes was for the UCLA group to get BBN to make IMP changes they wanted.
- * The TCP proposal (INWG #39) and a conceptually similar proposal from the Cyclades group (INWG #42) were submitted to INWG at approximately the same time. INWG #39 specifically states it is a refinement of ideas developed in a meeting which included Scantlebury and Zimmermann. INWG #48 proposes an experimental packet format which serves both the INWG #39 proposal and the INWG #43 (a refinement of INWG #42) proposal. It should be clear that both proposals were part of a larger activity.

Cheers,
Alex